



**DEPARTMENT of AGRICULTURE  
and NATURAL RESOURCES**

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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT  
APPLICATION NO. 8774-3, Upland Hutterian Brethren**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 8774-3, Upland Hutterian Brethren, 24221 412th Avenue, Artesian SD 57314.

The Chief Engineer is recommending APPROVAL of Application No. 8774-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. Water Permit No. 8774-3 authorizes storage of up to 66 acre-feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.
3. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Eric Gronlund, Chief Engineer  
August 16, 2023

*Report to the Chief Engineer*  
*Water Permit Application No. 8774-3*  
*Upland Hutterian Brethren*  
*August 7, 2023*

Water Permit Application No. 8774-3 proposes to appropriate water at a maximum instantaneous diversion rate of 1.11 cubic feet of water per second (cfs) of runoff from an unnamed tributary of the James River impounded in a storage dam (estimated storage capacity of 66 acre-feet) located in the SE  $\frac{1}{4}$  NW  $\frac{1}{4}$  of Section 25 for the subsurface drip irrigation of 136.4 acres located in the SE  $\frac{1}{4}$  of Section 25, all in T105N-R60W. This site is located in Sanborn County, approximately 8 miles north of Mitchell, South Dakota.

**Water Source:** Unnamed tributary of the James River

**South Dakota Codified Laws (SDCL) and Administrative Rule of South Dakota (ARSD):**

**SDCL 46-2A-9**

Pursuant to SDCL 46-2A-9, "A permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant's proposed use, that the diversion point can be developed without unlawful impairment of existing domestic water uses and water rights, and that the proposed use is a beneficial use and in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by SDCL 46-2-9 and 46-2-11."

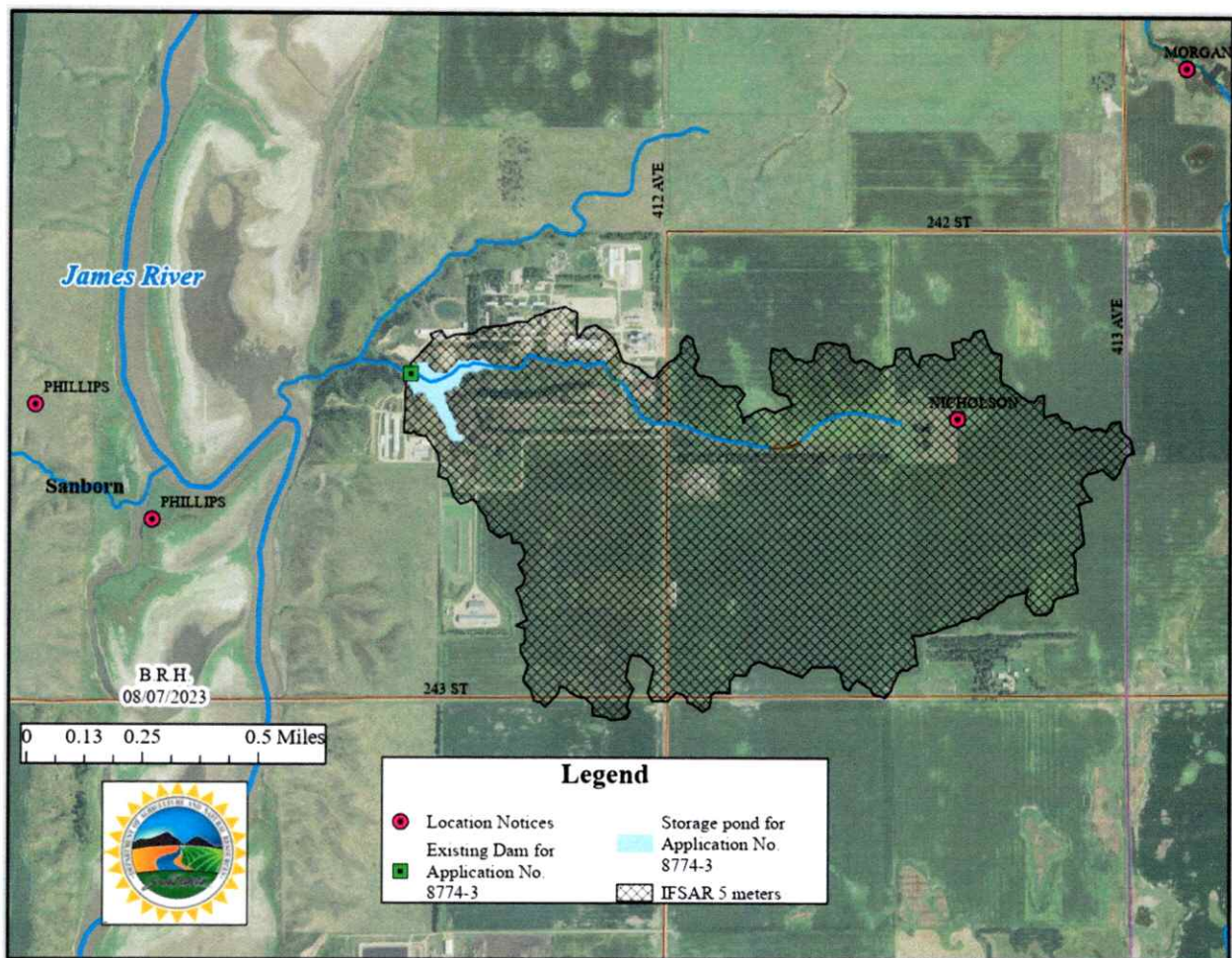
This report will address availability of unappropriated water and potential for unlawful impairment to existing rights that are pertinent to this application.

**Review of the Water Source:**

Water Permit Application No. 8774-3 proposes to appropriate 1.11 cfs from runoff impounded in a storage dam on an unnamed tributary of the James River. This unnamed tributary is located within the James River drainage basin in southeastern Sanborn County. The tributary is approximately 1.5 miles long and generally flows westward to the James River. Like Davison County to the south, smaller tributaries to the James River are typically intermittent, generally flowing only during spring and early summer from rainfall and snowmelt (Hansen, 1983).

## Water Availability:

The watershed area above the existing dam location was delineated using NRCS Engineering Tools Watershed Delineation for ArcGIS Pro (USDA-NRCS, 2023a). The elevation data used is an Interferometric synthetic aperture radar (IFSAR) DTM (Digital Terrain Model) dataset with 5-meter grid spacing. A digital terrain model is a bare-earth elevation model made of point data. The data is from Intermap Technologies, Inc. (Intermap Tech. Inc.). The resulting surface area of the watershed was delineated to be 0.88 square miles, or approximately 560.8 acres. A map of the existing dam and storage pond for Application No. 8774-3 and the watershed delineation can be seen in Figure 1.



**Figure 1:** Map of the approximate watershed delineation above the existing dam location made using the IFSAR 5-meter spaced dataset, as well as nearby location notices (Intermap Tech. Inc.; Water Rights, 2023b).

The NRCS annual surface yield method for South Dakota was used to estimate annual surface yield for the drainage area upstream of the dam location (USDA-NRCS, 1984). This NRCS method estimates the volume of runoff which can be expected for a twelve-month period at certain annual probabilities using contributing drainage area, soil cover complex number (runoff curve number, CN), and watershed location on an isogram map (USDA-NRCS, 1984).

The soil cover complex number, or the runoff curve number (CN) is necessary to determine the annual surface yield using the NRCS method (USDA-NRCS, 1984). The determination of the runoff curve number depends on the delineated watershed's soil and cover conditions, represented as hydrologic soil group, cover type, treatment, and hydrologic condition (USDA-NRCS, 1986). The general cover type for the delineated watershed is cultivated without conservation treatment (USDA-NRCS, 1984). Using USDA-NRCS Soil Survey, a shapefile of the delineated watershed using 5-meter IFSAR data was imported to determine hydrologic soil groups for regions of the watershed (Figure 2). Using cover type and hydrologic soil group, a runoff curve number was determined by calculating the weighted average of hydrologic soil groups and their respective curve numbers and rounding to the nearest whole number. This method can be seen on Table 1. Runoff curve numbers range from 40 to 100, and a higher curve number means that more runoff occurs in the watershed (USDA-NRCS, 1986).

The NRCS method is then used to determine the volume of runoff which can be expected for a twelve-month period. For example, an 0.8 probability of occurrence has an 80% chance of occurring each year. The annual surface yields for the drainage area at certain annual probabilities are presented in Table 2.





**Figure 2:** Shapefile of the delineated watershed from 5-meter spaced IFSAR data to determine hydrologic soil groups as determined by soil map units (USDA-NRCS, 2023b).

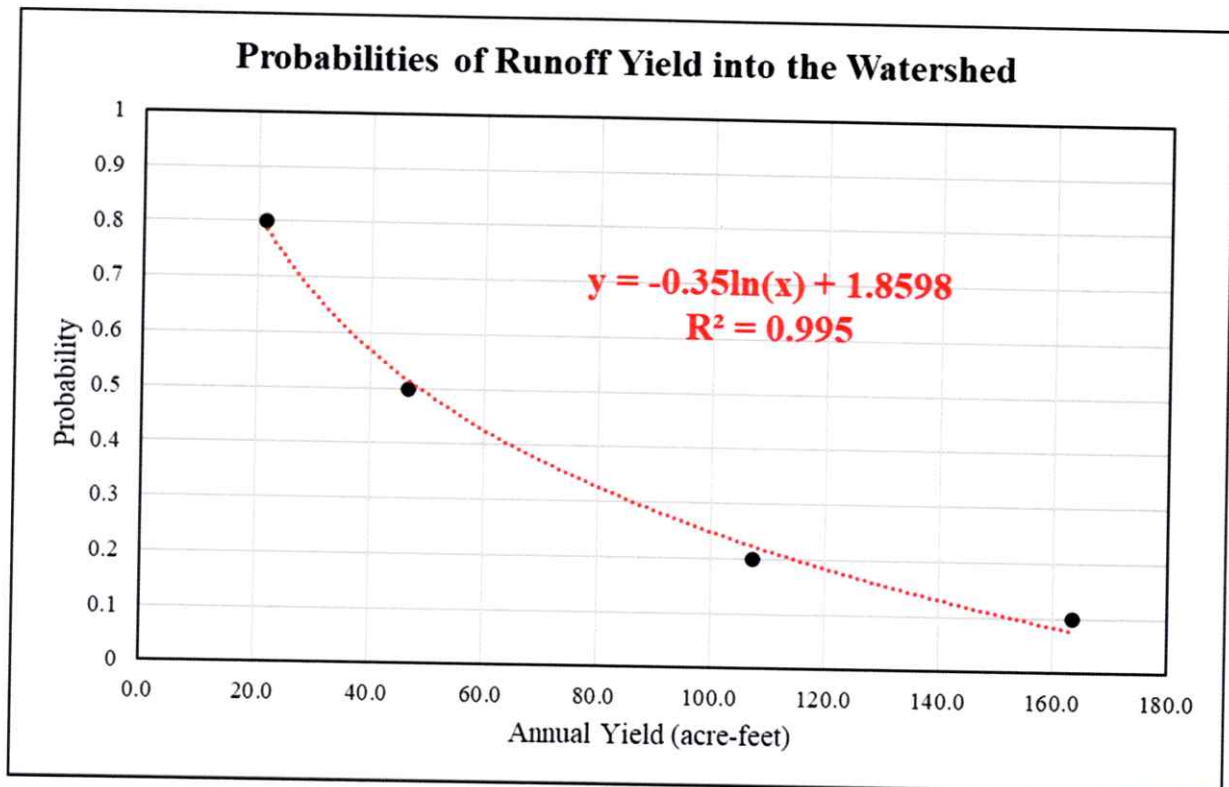
**Table 1:** Weighted average of hydrologic soil group ratios for cultivated land without conservation treatment (USDA-NRCS, 1984) to determine curve number.

Soil Group	CN	Map Unit Symbol	Weight	Weighted Values
A	72	BaE	0.096	6.912
B	81	CoA	0.736	59.616
C	88	HfA	0.123	10.824
D	91	Tb	0.046	4.186
			<b>Weighted Average CN</b>	<b>81.538</b>
			<b>CN</b>	<b>82</b>

**Table 2:** Estimated Total Annual Yield of Surface Runoff (USDA-NRCS, 1984) using an estimated watershed area of approximately 560.8 acres using the 5-meter IFSAR dataset (USDA-NRCS, 2023a; Intermap Tech. Inc.).

Probability of Occurrence	Inches of Annual Yield per Acre	Annual Yield (Acre-feet)
0.8	0.46	21.5
0.5	1	46.7
0.2	2.3	107.5
0.1	3.5	163.6

Normal storage capacity of the pond is estimated to be approximately 66 acre-feet as submitted with Application No. 8774-3. To determine the probability of occurrence for 66 acre-feet of water in the storage pond, the total runoff from Table 2 was plotted against the probability of occurrence, shown in Figure 3. The closer an r square value is to 1, the data is better correlated, and there is more reliability in a trendline. Solving the trendline for a volume of 66 acre-feet results in an estimated annual probability of approximately 40% to go from dry to full normal storage.



**Figure 3:** Plot of annual yield for the watershed above the proposed dam against the probability of occurrence. Note that this plot and trendline is only applicable for this specific watershed location and area.

Annual water losses from the reservoir are mainly due to evaporation and seepage. It has been found that evaporation from a shallow lake, wet soil, or other moist natural surfaces is roughly 70% of the evaporation from a Class A pan for the same conditions (Farnsworth and Thompson, 1982). At the location of the storage pond, the estimated average pan evaporation rate for April through October is 49 inches/year, and for November through March is 9.5 inches/year (Poudyal, 2006). This adds up to a pan evaporation annual total of 58.5 inches/year, or approximately 4.9 feet/year. To account for evaporation from natural surfaces, 70% of that rate is approximately 3.4 feet/year.

Average annual precipitation in the Mitchell, South Dakota area (approximately 8 miles north of the storage pond) is 22.83 inches/year or 1.9 feet (U.S. Climate Data, 2023). Net loss between direct precipitation and evaporation is approximately 1.5 feet. Based on the surface area of the impoundment and the estimated net loss between evaporation and direct precipitation, the lost storage in the impoundment dam is approximately 8.2 acre-feet. Estimated loss due to seepage from a dam is not available since this is not known until after years of operation and is typically not measured (Kilts, 2022).

Based on the NRCS annual surface runoff yield estimates, the amount of runoff needed to fill the existing reservoir to the estimated storage capacity (66 acre-feet) from dry has an approximately 40% chance of occurrence annually. This estimate is not a guarantee of what will occur in any given year, but an on average, over time, estimate. The water source may not be a reliable source during multi-year drought periods. Full use of the 66 acre-feet of storage per year would allow for the application of 5.8 inches per acre per year over the proposed number of acres for irrigation.

#### **Existing Uses:**

There are no water rights/permits on file to appropriate water from the storage pond for this application or between the pond and the tributary's confluence with the James River. There is a location notice within the delineated watershed above the dam location (Figure 1) (Water Rights, 2023a and 2023b). Since the dam is downstream of the nearby location notice, and the runoff water in the watershed flows northwest, the location notice should not be affected by the water entrapped by the storage pond. Other location notices to the west of the storage pond are also likely not be affected as any runoff water flowing to these locations will be coming from the west. A map of the location of the dam and the nearby location notices can be seen on Figure 1.

Given the lack of water rights/permits within the watershed and the storage pond, and the lack of complaints for appropriative water uses nearby since the dam has been built (Water Rights, 2023c), this application, if approved, is not expected to unlawfully impair existing appropriative uses or downstream domestic uses.

#### **Review of the Dam:**

ARSD Chapter 74:02:08 Safety of Dams provides "minimum standards for design, construction, alteration, maintenance, and repair of dams and to prevent loss of life." ARSD 74:02:08:06 provides classification of dams, determined either by the maximum storage capacity or height, whichever gives the larger size category.

An Upland Hutterian Brethren representative indicated the dam was constructed around 1987 and the original 18-inch steel pipe that acted as the primary spillway was plugged in 2022 and replaced with a 6-foot primary outlet. The dam has a height of 52 feet and an estimated normal storage capacity of 66 acre-feet. The South Dakota Safety of Dams Rules apply when the conditions are met under ARSD 74:02:08:01(7):

"an artificial barrier, including appurtenant works, which impounds or diverts water and which is 25 feet or more in height from the natural bed of the stream or watercourse

measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum water storage elevation or has an impounding capacity at maximum water storage elevation of 50 acre-feet or more. A barrier is not considered a dam for the purpose of this chapter if the height does not exceed 6 feet regardless of storage capacity or if the storage capacity at maximum water storage elevation does not exceed 15 acre-feet regardless of height.”

The height of the proposed dam exceeds 6 feet and the maximum storage exceeds 50 acre-feet; therefore, the South Dakota Safety of Dams Rules apply to this structure as stated in the design information submitted with the application. The applicant did not submit plans and specification for review and approval prior to construction of the dam in the late 1980's. It is unknown whether the minimum spillway design flood requirements are met, and therefore any object built or placed below the dam may be at risk during a flood event.

Based on the provided dam height, dam storage, and level of development in the area downstream of the dam site, the dam will be classified as an intermediate-sized, category 3 dam under the ARSD Chapter 74:02:08 Safety of Dams Rules. A category 3 dam is defined as a low hazard dam whose failure may cause limited damage to agricultural lands or county and township roads or minimum economic loss. In the event of failure, the James River and the James River floodplain below the dam should absorb excess water. There does appear to be a small building within 0.1 miles southwest and downstream of the dam but is primarily out of the flood plain in the event of failure.

If in the future the dam is altered, fails and is reconstructed, or removed, the plans and specifications concerning these actions will need to be approved by the Chief Engineer of the Water Rights Program prior to construction. If future development occurs downstream of the dam (between the dam and the James River), it may change the hazard classification of the dam. If the hazard classification does change, then the dam will need to be brought into compliance with the requirements for the new hazard classification. It is the responsibility of the dam owner to monitor and maintain their dam.



**Conclusions:**

1. Water Permit Application No. 8774-3 proposes to appropriate water at a maximum instantaneous diversion rate of 1.11 cfs of runoff impounded in a storage dam (estimated storage capacity of 66 acre-feet) on an unnamed tributary of the James River located in the SE  $\frac{1}{4}$  NW  $\frac{1}{4}$  of Section 25 for the subsurface drip irrigation of 136.4 acres located in the SE  $\frac{1}{4}$  of Section 25, all in T105N-R60W.
2. The NRCS surface runoff yield method estimates a 40% annual probability for the storage pond to fill completely from dry to a full-service level of 66 acre-feet.
3. Approval of this application is not expected to unlawfully impair existing water rights/permits, location notices, or domestic uses.
4. The dam for Application No. 8774-3 was not reviewed for compliance with South Dakota's Safety of Dams Rules nor approved by the Chief Engineer prior to construction. Therefore, structures built below or in the vicinity of the dam may be at risk of damage in the event of dam failure due to non-compliance with construction standards.



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Reviewed by:



Whitney Kilts  
Natural Resources Engineer III  
SDDANR- Water Rights Program

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